
CLAIMS

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(57) [Claim(s)]
[Claim 1] The detection equipment formed in the body of a foil loader detects request rating. Input the detecting signal of said detection equipment into the recording device attached in said body of a foil loader, and this is made to record on a record medium. In the operation analysis approach of the foil loader which reads a record medium in a recording device by drawing, reads this record medium by the analysis apparatus by the side of a manager, and was analyzed after activity termination Said detection equipment is used as the rotational frequency sensor for engines, a fuel sensor, and the sensor for load detection. The frequency of the engine speed detected by said engine-speed sensor for engines is recorded on said record medium. When a bucket rise-and-fall boom goes astern with a standing-up posture and a car goes astern with a maximum lifting height, the bucket which **** earth and sand etc. using said sensor for load detection detects the load of a bucket from from, and records on said record medium. The fuel consumption detected by the fuel sensor in the cycle time and this cycle time which loaded with the clock function built in said recording device, and each loading took using the completion signal is recorded on said record medium. The operation analysis approach of the foil loader it was made to compute and output the rating per time amount, and the rating per fuel consumption while outputting the frequency distribution of the engine speed which changes with said analysis apparatus according to a load.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
<Field of the Invention> This invention relates to the operation analysis approach for reporting the rating of for example, a foil loader to a user.
The <conventional technique> There are JP,62-44311,B, JP,62-45586,B, and JP,62-45587,B as a conventional technique of the operation analysis approach of an industrial car. In order that these may record the operation data of a dump truck, the data recorder carried by construction equipments, such as a dump truck, is equipped with the card mold memory which can be detached and attached freely. The operation data of the construction equipment concerned inputted from the operation data and the external input means of the construction equipment concerned detected from the sensor formed in this construction equipment are recorded on the above-mentioned card mold memory. The data processor in which the card mold memory after this record was prepared in the administration office is equipped, and it is made to carry out analysis processing of said recorded data.
<Trouble which invention tends to solve> Therefore, whether synthetic working capacity improved in after a shift of a driver or a facility of a car etc. can grasp immediately the proper activity which deserves the time amount spent on the activity, and fuel consumption (cost) to get to know the rating (loading load) per being line intermediary ****, i.e., time amount, and the rating per fuel consumption (loading load). Although the information for therefore carrying out improvement of the activity approach, maintenance check, **** management, etc. to writing in each data, for example, vehicle speed data, mileage data, engine-speed data, loading weight data, etc., and only analyzing the data of these each in the former can be acquired, about the mutual relation of each data, it can grasp enough, and it is inside ****. For this reason, the rating per time amount and the rating per fuel consumption which can grasp the right and wrong of working capacity at a glance cannot be obtained, but it is only necessary to grasp the right and wrong of synthetic working capacity from analysis results, such as rating, fuel consumption, and working hours, complicated, and ******.
This invention aims at offer of the operation analysis approach of a foil loader convenient for the user who performs grasp of rating, and grasp of fuel consumption to coincidence, computes correctly the rating per time amount, and the rating per fuel consumption in view of the above-mentioned trouble, and can grasp the right and wrong of synthetic working capacity at a glance.
<Means for solving a trouble> This invention In order to attain the above-mentioned purpose, the detection equipment 2 formed in the body 1 of a foil loader detects request rating. Input the detecting signal of said detection equipment 2 into the recording device 3 attached in said body 1 of a foil loader, and this is made to record on a record medium 4. In the operation analysis approach of the foil loader which reads a record medium 4 in a recording device 3 by drawing, reads this record medium 4 by the analysis apparatus 5 by the side of a manager, and was analyzed after activity termination Said detection equipment is used as the rotational frequency sensor 6 for engines, the fuel sensor 8, and the sensors 12, 13, 15, and 16 for load detection. The frequency of the engine speed detected by said engine-speed sensor 6 for engines is recorded on said record medium 4. When the bucket rise-and-fall boom 10 goes astern with a standing-up posture and a car goes astern with a maximum lifting height, the bucket 9 which **** earth and sand etc. using said sensors 12, 13, 15, and 16 for load detection detects the load of a bucket 9 from from, and records on said record medium 4. The fuel consumption detected by the fuel sensor 8 in the cycle time and this cycle time which loaded with the clock function built in said recording device 3, and each loading took using the completion signal is recorded on said record medium 4. While outputting the frequency distribution of the engine speed which changes with said analysis apparatus 5 according to a load, it is made to compute and output the rating per time amount, and the rating per fuel consumption.
< ** ** > According to this invention, the engine-speed sensor 6 for engines detects an engine speed, and engine-speed frequency is memorized to a record medium 4 using the frequency counter of a recording apparatus 3.
Moreover, after a car's moving forward, ****(ing) earth and sand etc. in a bucket 9 and raising a bucket 9, While a car goes astern, raise the bucket rise-and-fall boom 10, and if the earth and sand which ****(ed) in the bucket 9 are loaded into a dump truck etc., it will set to the loading activity of ****** when. The lifting signal of the sensors 13, 15, and 16 for load detection to the bucket 9, When a car go-astern signal and the maximum-lifting-height signal of the bucket rise-and-fall boom 10 are inputted, as what can detect that true ********, the sensor 12 for load detection detects the load of the bucket 9 at this time, and it records on a record medium 4.
Furthermore, the cycle time which loaded with the clock function built in a recording device 3, and each loading activity took using the completion signal is recorded on a record medium 4. It can come, simultaneously the fuel sensor 8 detects fuel consumption in each cycle time, and it records on a record medium 4.
After a series of activities are completed, it reads and analyzes by drawing and the analysis apparatus 5 from the recording apparatus 3 of a record medium 4, while displaying the frequency distribution of the engine speed which changes according to a load on a display, the rating per time amount and the rating per fuel consumption are computed, and it collects into a report etc. and prints out. therefore, the proper activity which deserves the time amount spent on the activity, and fuel consumption (cost) — line intermediary **** ******** — when — ** — while being able to grasp the right and wrong of synthetic working capacity at a glance, a **** load can be presumed based on the frequency distribution of an engine speed, and exact life estimation and failure generating anticipation are attained.
< fruit ** Example > One example of the operation analysis approach of this invention foil loader is hereafter explained based on a drawing. For the perspective view of the data result analysis apparatus in the operation analysis of the foil loader which Fig. 1 shows one example of this invention, process drawing in which Fig. 2 is the same and showing the processing sequence of data, and Fig. 3 , the side elevation of a working-level month car and Fig. 4 are [a data table and Fig. 6 of the example Fig. of format of the report of a rating result and Fig. 5] frequency analysis graphs.
And this invention operation analysis approach is for analyzing the working capacity of a wheel loader etc. The detection equipment 2 formed in the body 1 of a foil loader detects request rating. Input the detecting signal of said detection equipment 2 into the recording device 3 attached in said body 1 of a foil loader free [attachment and detachment], and this is made to record on a record medium 4, and a record medium 4 is read in a recording device 3 by drawing, this record medium 4 is read by the analysis apparatus 5 by the side of a manager, and it is made to analyze after activity termination.
The engine-speed sensor 6 (tacometer generator) arranged on the output shaft of Engine EG in order that detection equipment 2 might detect the engine speed of Engine EG, as shown in Fig. 3 , The rotational frequency sensor 7 arranged on the driving shaft in order to detect the vehicle speed, and the fuel sensor 8 arranged on the fuel-supply way in order to detect the flow rate of a fuel and to measure fuel consumption, The pressure sensor 12 (pressure head) for oil pressure detection arranged on the boom hydraulic cylinder 11 of the bucket rise-and-fall boom 10 in order to detect the load of a bucket 9, The potentionmeter 13 which detects the stroke of a boom hydraulic cylinder 11 in order to detect the load of a bucket 9 with the maximum lifting height of a bucket 9, The non-contact limit switch 15 allotted to the bucket hydraulic cylinder 14 in order to detect the load of a bucket 9 with the standing-up posture of a bucket 9, When a car goes astern, in order to start detection of the load of a bucket 9 from from, it has the go-astern sensor 16 arranged on the transmission of the body 1 of a foil loader.
And the load cell 18 which measures the load (movable load) in the maximum lifting height of a bucket 9 by the load detecting signal which consists of

a pressure sensor 12, potentionmeter 13, a limit switch 15, and a go-astern sensor 16 is formed. A load cell 18 carries out operation measurement on real time with the signal of each of said sensors 12, 13, 15, and 16, and the information is inputted into the record medium 4 (IC card) of a recording device 3.

Moreover, a recording apparatus 3 inputs the engine-speed information from said engine-speed sensors 6 and 7 and vehicle speed information, and the fuel consumption information from the fuel sensor 8, and makes fuel consumption, engine-speed frequency, and vehicle speed data record on a record medium 4 using the frequency counter 17. This recording device 3 is attached in the body 1 of a car free [attachment and detachment]. Data [like / the data table showing a record medium 4 in Fig. 5] are inputted.

The analysis apparatus 5 which analyzes the data of the record medium 4 after data logging is formed. Moreover, this analysis apparatus 5 The reader 22 which reads the information on the record medium 4 picked out from the recording device 3 after activity termination, The data-processing machine 23 (personal computer) which analyzes the information read with this reader 22, and carries out data processing to the format of the on-site measurement debrief report (news flash) like the 4th drawing 4 Fig. and which carries out a screen display to display 23a, It consists of printers 24 which print out screen-display data.

In the above-mentioned configuration, if a user starts an activity, detection equipment 2 will start detection of request rating. That is, the engine-speed sensor 6 detects the engine speed under activity. Fuel consumption detects the flow rate of the fuel which flows a fuel-supply way by the fuel sensor 8. The rotational frequency sensor 7 detects the vehicle speed. The detection data of these sensors 6, 7, and 8 are written in the record medium 4 of a recording device 3 using the frequency counter 17.

Moreover, ******, such as earth and sand, are detected as follows. After the body 1 of a foil loader advancing, ****(ing) earth and sand etc. in a bucket 9 and raising a bucket 9, a boom 10 is raised going astern and a dump truck etc. is loaded. As what can detect that true ******** when the lifting signal of a bucket 9, a car go-astern signal, and the maximum-lifting-height signal of a boom 10 are inputted by this activity of a series of, when a signal is inputted from each sensor, a pressure sensor 12 detects a load, data processing is carried out with a load cell 18, and it records on IC card 4 of a recording device 3.

While loading with the cycle time which loaded with the clock function especially built in a recording device 3, and each loading took using the completion signal and recording a load on a record medium 4, the fuel consumption which said cycle time took is detected and recorded from the fuel sensor 8, and the rating per fuel consumption is computed by the analysis apparatus 5, and it prints out. The cycle time says time amount until it detects the next ******** here, after detecting true ********. Viewing indicates this intercropping business process and it is made reference of an improvement of the next activity approach.

And after a series of activities are completed, a user analyzes by the analysis apparatus 5 installed from insertion opening of the recording device 3 of a record medium 4 to drawing and the management office. That is, a record medium 4 is inserted in the reader 22 of an analysis apparatus 5, and a treater 23 is operated, and as shown in the 4th drawing 4 Fig. and Fig. 6 , it displays on display 23a. Moreover, the count of an activity (time), the load load t in each activity, the accumulation load load T, the cycle time of each activity, elapsed time, and fuel consumption cc can also be shown like Fig. 5 .

Fig. 6 shows the frequency distribution of the rotational frequency of the engine by the frequency counter 17, frequency (percent) is shown on an axis of ordinate, and a rotational frequency is shown on an axis of abscissa by it. A **** load can be presumed in this engine rotation frequency analysis (the frequency of a part where a rotational frequency becomes [a **** load] size at the adult time becomes high), and exact life estimation and failure generating anticipation are attained. * mark of front Naka is the average.

Moreover, a report as shown in Fig. 4 is displayed by operating a treater 23 suitably. And that with which a user is finally provided is this report, and, therefore, a printer 24 prints this out. Measurement days and months, a measurement result, and workability ability are indicated by this report.

Thus, there is the following effectiveness by the detection equipment 2 formed in the body 1 of a foil loader having detected request rating, inputting the detecting signal of said detection equipment 2 into the recording device 3 attached in said body 1 of a foil loader, having made this record on a record medium 4, reading a record medium 4 in a recording device 3 by drawing, reading this record medium 4 by the analysis apparatus 5 by the side of a manager, and having made it analyze after activity termination.

That is, the cycle time which loaded with the clock function built in a recording device 3, and each loading took using the completion signal is grasped, by computing the rating per time amount, and the rating per fuel consumption by detecting the rating and fuel consumption in each cycle time, the related ****** evaluation of what was discussing workability ability and fuel consumption partially conventionally can be carried out, and the right and wrong of synthetic working capacity can be grasped at a glance from an analysis result. Moreover, if the rating per time amount is compared with the routing data therefore obtained to viewing, the improving point of an activity can judge immediately and can carry out suitable advice for a user's activity method improvement.

Furthermore, according to the engine-speed distribution (transmission output engine-speed distribution, Boom CYL, pressure distribution, etc. are measured if needed) measured to coincidence, whenever [which is depended on the difference of how a foil loader is used / severe] can be judged, and anticipation of failure correction expense and calculation of machine cost can be performed.

Furthermore, since it is enough if removal has the attachment which attaches a recording device 3 in the body 1 of a foil loader as long as 30 minutes for about 1 hour, a recording device 3 is attached simply and removal is possible.

In addition, as for this invention, it is needless to say that it is not limited to the above-mentioned example and many corrections and modification can be added to the above-mentioned example within the limits of this invention.

For example, ****** of a record medium is also good not only on an IC card but a record tape etc. like the above-mentioned example. Furthermore, detection equipment may use other sensors which can be added to instead of or this not only for the sensor like the above-mentioned example but for this.

<Effect of the invention> It sets to this invention a passage clear from the above explanation. Detection equipment is used as the rotational frequency sensor for engines, and a fuel sensor and the sensor for load detection. The frequency of the engine speed detected by the engine-speed sensor for engines is recorded on a record medium. When a bucket rise-and-fall boom goes astern with a standing-up posture and a car goes astern with a maximum lifting height, the bucket which **** earth and sand etc. using the sensor for load detection detects the load of the bucket of a from, and records on a record medium. The fuel consumption detected by the fuel sensor in the cycle time and the cycle time which loaded with the clock function built in a recording device, and each loading took using the completion signal is recorded on a record medium. While outputting the frequency distribution of the engine speed which changes with analysis apparatus according to a load Since he is trying to compute and output the rating per time amount, and the rating per fuel consumption, the related ****** evaluation of what was discussing workability ability and fuel consumption partially conventionally can be carried out, and the right and wrong of synthetic working capacity can be grasped at a glance from an analysis result. Moreover, if the rating per time amount is compared with the routing data therefore obtained to viewing, the improving point of an activity can judge immediately and can carry out suitable advice for a user's activity method improvement.

Furthermore, in order to detect true ******** in the loading activity of a foil loader, a bucket can detect the load of the bucket of a from, when a bucket rise-and-fall boom goes astern with a standing-up posture and a car goes astern with a maximum lifting height, and can acquire the information (rating per time amount, and rating per fuel consumption) suitable for the foil loader which can grasp the working efficiency of a foil loader appropriately by making this reflect as rating.

And a **** load can be presumed based on the frequency distribution of the engine speed outputted to coincidence, exact life estimation and failure generating anticipation are attained, and when whenever [which is depended on the difference of how a foil loader is used / severe] can be judged and anticipation of failure correction expense and calculation of machine cost can be performed, there is ****** when.

[Translation done.]

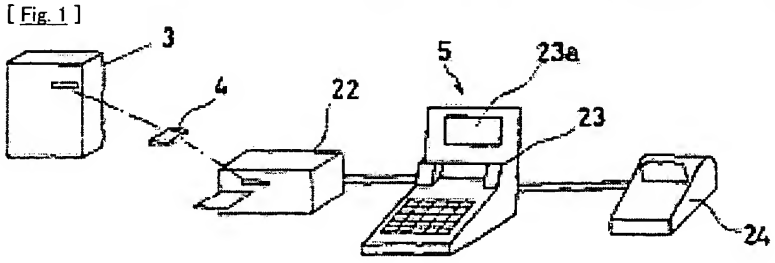
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
For the perspective view of the data result analysis apparatus in the operation analysis of the foil loader which Fig. 1 shows one example of this invention, process drawing in which Fig. 2 is the same and showing the processing sequence of data, and Fig. 3 , the side elevation of a working-level month car and Fig. 4 are [a data table and Fig. 6 of the example Fig. of format of the report of a rating result and the 5th drawing 5 Fig.] frequency analysis graphs.
1: The body of a foil loader, 2:detection equipment, 3:recording device, 4:record medium, 5:analysis apparatus, 6:rotational frequency sensor, 17:frequency counter, 18:load cell, 22:reader, 23:data-processing machine, 24 : printer.

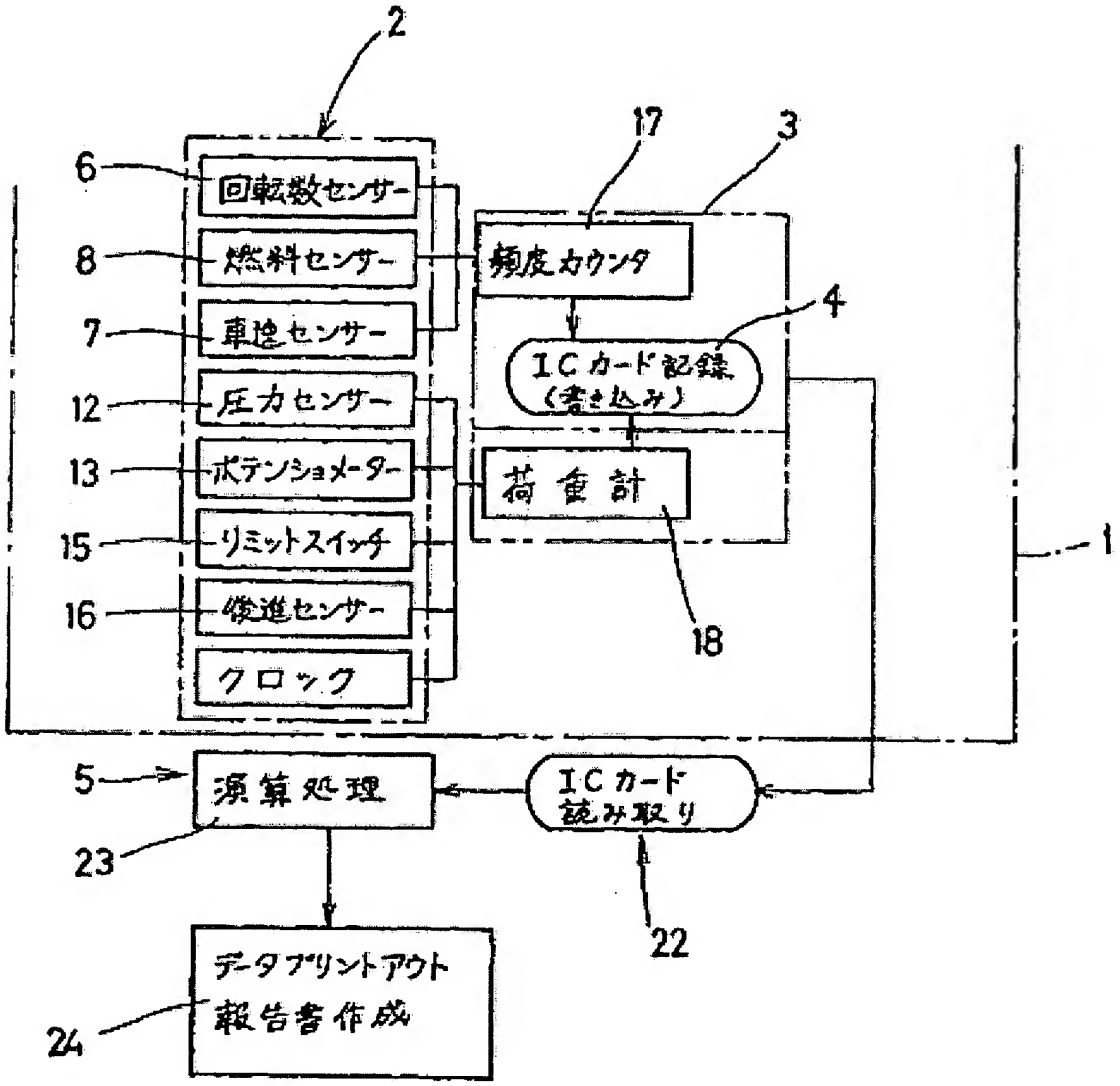
[Translation done.]

DRAWINGS

[Fig. 1]



[Fig. 2]



1：ホイルローダ本体　　17：頻度カウンタ

2：検出装置　　18：荷重計

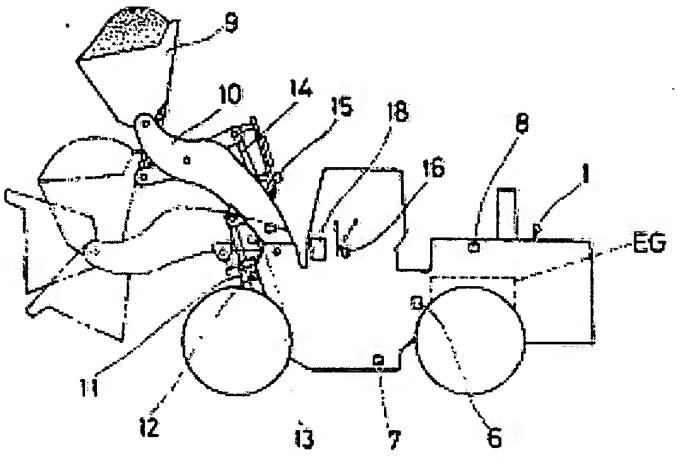
3：記録装置　　22：読取装置

4：記録媒体　　23：演算処理器

5：分析装置　　24：プリンター

6：回転数センサー

[Fig. 3]



[Fig. 4]

現場計測結果報告書（速報）

1．計測月日

開始　87/07/10　8：9:50

終了　87/07/10　11:39:31

2．計測結果

1）総作業量　1035.44 トン

2）総サイクル数　202 回

3）平均サイクルタイム　3：2 分：秒

4）平均積載量　5.13 トン

5）燃料消費量　20.88 ﾘｯﾄﾙ/Hr

3．作業性能

燃料当り作業量　14.20 トン/リｯﾄﾙ

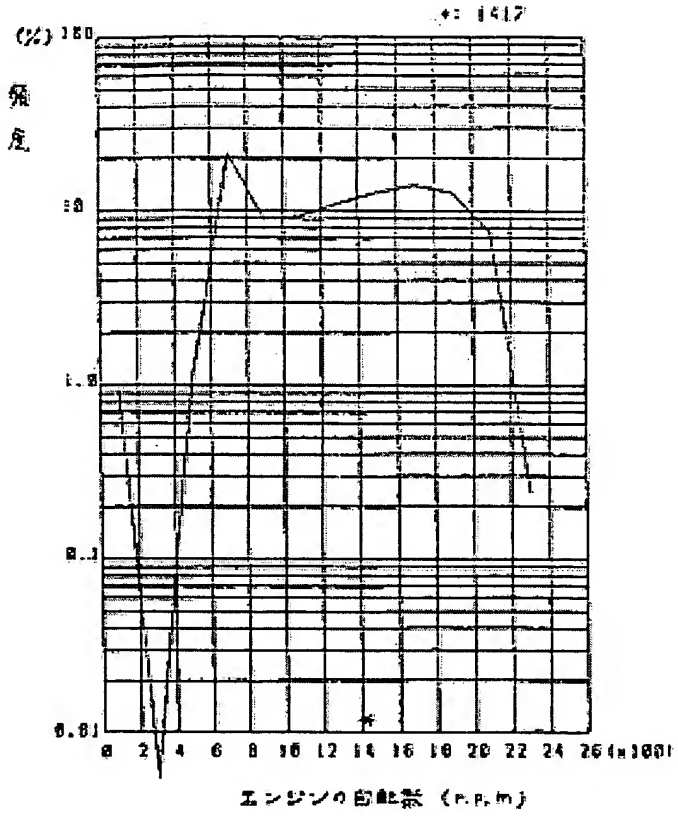
時間当り作業量　296.72 トン/Hr

[Fig. 5]

7/05/25

回数(回)	荷重(t)	累積(t)	サイクルタイム	経過時間	燃費(CC)
1	4.17	4.90	0:39	14: 8:40	95
2	3.06	9.96	0:36	14: 9:16	195
3	3.15	13.11	1:42	14:10:58	175
4	3.33	16.44	0:31	14:11:29	375
5	3.17	19.61	0:28	14:11:58	160
6	3.19	22.80	0:27	14:12:25	140
：	：	：	：	：	：
25	3.37	90.05	0:40	14:24:31	390
26	3.71	93.76	0:37	14:25: 8	170
27	3.51	97.27	0:37	14:25:45	155
28	3.37	100.64	0:47	14:26:32	180
29	3.72	104.36	0:35	14:27: 7	165

[Fig. 6]



[Translation done.]

PATENT ABSTRACTS OF JAPAN

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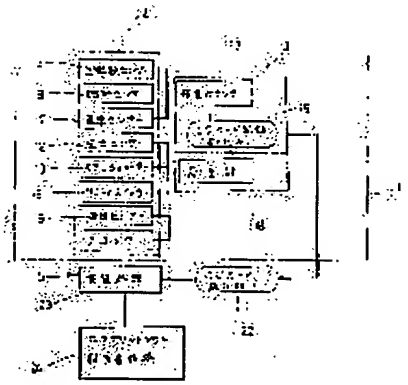
(54) WORK ANALYSIS METHOD FOR WHEEL LOADER

(57)Abstract:
PURPOSE: To simultaneously recognize a workload and fuel consumption and to accurately calculate the workload per fuel consumption by turning a detector to a fuel sensor and a sensor for load detection.
CONSTITUTION: The detector 2 is turned to the fuel sensor 8 and the sensors 12, 13, 15 and 16 for the load detection, loaded loads are recorded in a recording medium along with cycle time required for each loading by using a clock function incorporated in a recorder 3 and loading completion signals, the fuel consumption required in the cycle time is detected from the fuel sensor 8 and recorded and the workload per fuel consumption is calculated by an analysis device 5 and printed out. Thus, the workload and the fuel consumption are simultaneously recognized and the workload per fuel consumption is accurately calculated.



LEGAL STATUS

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(56)参考文献　特開　昭59－96339（ＪＰ，Ａ）
特開　昭60－91215（ＪＰ，Ａ）
特開　昭54－121159（ＪＰ，Ａ）
特公　昭62－45587（ＪＰ，Ｂ２）

(54)【発明の名称】　ホイルローダの作業分析方法

1

(57)【特許請求の範囲】

【請求項１】ホイルローダ本体に設けられた検出装置により所望作業量を検出し、前記ホイルローダ本体に取付けられた記録装置に前記検出装置の検出信号を入力してこれを記録媒体に記録させ、作業終了後に記録媒体を記録装置から取出し、該記録媒体を管理者側の分析装置で読取り分析するようにしたホイルローダの作業分析方法において、前記検出装置をエンジン用回転数センサーと燃料センサーと荷重検出用センサーとし、前記エンジン用回転数センサーにより検出したエンジン回転数の頻度を前記記録媒体に記録し、前記荷重検出用センサーを用いて土砂等を載積するバケツトが起立姿勢でバケツト昇降ブームが最大揚高で車両が後進したときからバケツトの負荷を検出して前記記録媒体に記録し、前記記録装置に内蔵する時計機能と積込み完了信号とを用いて各積込

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みに要したサイクルタイムおよび該サイクルタイムにおいて燃料センサーにより検出した燃費を前記記録媒体に記録し、前記分析装置により負荷に応じて変化するエンジン回転数の頻度分布を出力するとともに、時間当たりの作業量および燃費当たりの作業量を算出し出力するようにしたホイルローダの作業分析方法。

【発明の詳細な説明】

＜産業上の利用分野＞

本発明は、例えばホイルローダの作業量をユーザーに報告するための作業分析方法に関する。

＜従来技術＞

産業用車両の作業分析方法の従来技術として特公昭62－44311号、特公昭62－45586号、および特公昭62－45587号がある。これらは、ダンプトラツクの稼動データを記録するために、着脱自在のカード型メモリをダンプト

ラック等の建設機械に搭載されたデータ記録装置に装着して、該建設機械に設けられたセンサーより検出された当該建設機械の稼動データと外部入力手段から入力された当該建設機械の稼動データを上記カード型メモリに記録し、該記録後のカード型メモリを管理事務所に設けられたデータ処理装置に装着して前記記録されたデータを分析処理するようにしている。

＜発明が解決しようとする問題点＞

運転手の交替や車両の設備後等において総合的な作業能率が向上したか否かは、作業に費やされた時間や燃費（経費）に値する適正な作業を行つているかどうかすなわち時間当たりの作業量（積込み荷重）および燃費当たりの作業量（積込み荷重）を知ることによつて即座に把握することができる。従来においては、個々のデータ、例えば車速データ、走行距離データ、エンジン回転数データ、積載重量データ等を書き込み、これら個々のデータを単に分析することによつて作業方法の改善、保守点検、嫁動管理等を行なうための情報を得ることができるが、個々のデータの相互の関連については十分把握することができなかつた。このため、作業能率の善し悪しを一目で把握できる時間当たりの作業量および燃費当たりの作業量を得ることができず、単に作業量、燃費、作業時間等の分析結果から総合的な作業能率の善し悪しを把握する必要があり煩雑であつた。

本発明は、上記問題点に鑑み、作業量の把握と燃費の把握を同時に行ない、時間当たりの作業量および燃費当たりの作業量を正確に算出して総合的な作業能率の善し悪しを一目で把握できるユーザーに便利なホイルローダの作業分析方法の提供を目的とする。

＜問題点を解決するための手段＞

本発明は、上記目的を達成するために、ホイルローダ本体１に設けられた検出装置２により所望作業量を検出し、前記ホイルローダ本体１に取付けられた記録装置３に前記検出装置２の検出信号を入力してこれを記録媒体４に記録させ、作業終了後に記録媒体４を記録装置３から取出し、該記録媒体４を管理者側の分析装置５で読取り分析するようにしたホイルローダの作業分析方法において、前記検出装置をエンジン用回転数センサー６と燃料センサー８と荷重検出用センサー12,13,15,16とし、前記エンジン用回転数センサー６により検出したエンジン回転数の頻度を前記記録媒体４に記録し、前記荷重検出用センサー12,13,15,16を用いて土砂等を載積するバケット９が起立姿勢でバケット昇降ブーム10が最大揚高で車両が後進したときからバケット９の負荷を検出して前記記録媒体４に記録し、前記記録装置３に内蔵する時計機能と積込み完了信号とを用いて各積込みに要したサイクルタイムおよび該サイクルタイムにおいて燃料センサー８により検出した燃費を前記記録媒体４に記録し、前記分析装置５により負荷に応じて変化するエンジン回転数の頻度分布を出力するとともに、時間当たりの作業量および燃費当たりの作業量を算出し出力するようにしたものである。

＜作　用＞

本発明によると、エンジン用回転数センサー６によりエンジン回転数を検出し、記録装置３の頻度カウンターを使用してエンジン回転数頻度を記録媒体４に記憶する。

また、車両が前進し、土砂等をバケット９に載積してバケット９を起こした後、車両が後進しながらバケット昇降ブーム10を上昇させ、バケット９に載積した土砂等をダンプカー等に積載するといつた一連の積込み作業において、荷重検出用センサー13,15,16からバケット９の起こし信号と、車両後進信号と、バケット昇降ブーム10の最大揚高信号とが入力されたときにその真の載積重量が検出できるものとして、このときのバケット９の負荷を荷重検出用センサー12により検出して記録媒体４に記録する。

さらに、記録装置３に内蔵する時計機能と積込み完了信号とを用いて各積込み作業に要したサイクルタイムを記録媒体４に記録する。これと同時に、各サイクルタイムにおいて燃料センサー８により燃費を検出して記録媒体４に記録する。

一連の作業が終了すると、記録媒体４の記録装置３から取出し、分析装置５で読取り分析して、負荷に応じて変化するエンジン回転数の頻度分布をデイスプレイに表示するとともに、時間当たりの作業量および燃費当たりの作業量を算出し報告書等にまとめてプリントアウトする。したがつて、作業に費やされた時間や燃費（経費）に値する適正な作業を行つているかどうかといつた総合的な作業能率の善し悪しを一目で把握できるとともに、エンジン回転数の頻度分布に基づいて載積負荷が推定できて正確な寿命推定や故障発生予想が可能となる。

＜実　施　例＞

以下、本発明ホイルローダの作業分析方法の一実施例を図面に基づいて説明する。第１図は本発明の一実施例を示すホイルローダの作業分析におけるデータ結果分析装置の斜視図、第２図は同じくデータの処理順序を示す工程図、第３図は作業用車両の側面図、第４図は作業量結果の報告書の書式例図、第５図はデータ表、第６図は頻度解析グラフである。

そして、本発明作業分析方法は、ホイールローダの作業能率等を分析するためのもので、ホイルローダ本体１に設けられた検出装置２により所望作業量を検出し、前記ホイルローダ本体１に着脱自在に取付けられた記録装置３に前記検出装置２の検出信号を入力してこれを記録媒体４に記録させ、作業終了後に記録媒体４を記録装置３から取出し、該記録媒体４を管理者側の分析装置５で読取り分析するようにしたものである。

検出装置２は、第３図の如く、エンジンEGの回転数を検出するためにエンジンEGの出力軸に配された回転数セ

ンサー６（タコジエネレータ）と、車速を検出するため駆動軸に配された回転数センサー７と、燃料の流量を検出して燃費を計測するために燃料供給路に配された燃料センサー８と、バケット９の負荷を検出するためにバケット昇降ブーム10のブームシリンダー11に配された油圧検出用圧力センサー12（プレツシヤーヘツド）と、バケット９の最大揚高でバケット９の負荷を検出するためにブームシリンダー11のストロークを検出するポテンシヨンメーター13と、バケット９の起立姿勢でバケット９の負荷を検出するためにバケツトシリンダ14に配された無接点リミツトスイツチ15と、車両が後進したときからバケツト９の負荷の検出を開始するためにホイルローダ本体１のトランスミツシヨンに配された後進センサー16とを具えている。

そして、圧力センサー12、ポテンシヨンメーター13、リミツトスイツチ15および後進センサー16からなる荷重検出信号によりバケット９の最大揚高での負荷（積載荷重）を計測する荷重計18が設けられている。荷重計18は、前記各センサー12,13,15,16の信号によりリアルタイムで演算計測するもので、その情報は、記録装置３の記録媒体４（ICカード）に入力される。

また記録装置３は、前記回転数センサー6,7からのエンジン回転数情報および車速情報と、燃料センサー８からの燃費情報とを入力し、頻度カウンター17を使用して燃費、エンジン回転数頻度および車速データを記録媒体４に記録させるものである。この記録装置３は、車両本体１に着脱自在に取付けられる。記録媒体４は第５図に示すデータ表の如き、データが入力される。

また、データ記録後の記録媒体４のデータを分析する分析装置５が設けられ、該分析装置５は、作業終了後に記録装置３から取出した記録媒体４の情報を読取る読取装置22と、該読取装置22で読取られた情報を分析して第４図の如き現場計測結果報告書（速報）の形式に演算処理し、デイスプレイ23aに画面表示する演算処理器23（パーソナルコンピユーター）と、画面表示データをプリントアウトするプリンター24とから構成される。

上記構成において、ユーザーが作業を開始すると、検出装置２が所望作業量の検出を開始する。すなわち、回転数センサー６で作業中のエンジン回転数を検出する。燃費は、燃料供給路を流れる燃料の流量を燃料センサー８で検出する。車速は回転数センサー７で検出する。これらセンサー6,7,8の検出データは頻度カウンター17を用いて記録装置３の記録媒体４に書き込まれる。

また、土砂等の載積量は次のようにして検出される。ホイルローダ本体１が前進し、土砂等をバケット９に載積しバケット９を起こした後、後進しながらブーム10を上昇させ、ダンプカー等に積載する。この一連の作業でバケット９の起こし信号と、車両後進信号と、ブーム10の最大揚高信号とが入力されたときにその真の載積重量が検出できるものとして、夫々のセンサーから信号が入力されたときに、圧力センサー12により荷重を検出して荷重計18で演算処理して記録装置３のICカード４に記録する。

特に、記録装置３に内蔵する時計機能と積込み完了信号とを用いて各積込みに要したサイクルタイムとともに積込み荷重を記録媒体４に記録するとともに前記サイクルタイムに要した燃費を燃料センサー８から検出して記録し、分析装置５により燃費当たりの作業量を算出しプリントアウトする。ここでサイクルタイムは真の載積重量を検出した後次の載積重量を検出するまでの時間をいう。この間作業工程を目視にて記載し、後の作業方法の改善の参考にする。

そして一連の作業が終了すると、ユーザーは記録媒体４の記録装置３の挿入口から取出し、管理室に据え付けの分析装置５で分析する。すなわち、分析装置５の読取装置22に記録媒体４を挿入し、処理器23を操作して、第４図および第６図に示すようにデイスプレイ23aに表示する。また第５図のように、作業回数（回）、各作業における負荷荷重ｔ、累積負荷荷重Ｔ、各作業のサイクルタイム、経過時間、燃費ccを示すこともできる。

第６図は、頻度カウンター17によるエンジンの回転数の頻度分布を示し、縦軸に頻度（パーセント）、横軸に回転数を示す。このエンジン回転頻度解析により載積負荷が推定でき（載積負荷が大のときは回転数が大なる部分の頻度が高くなる）、正確な寿命推定や故障発生予想が可能となる。表中の＊印はその平均値である。

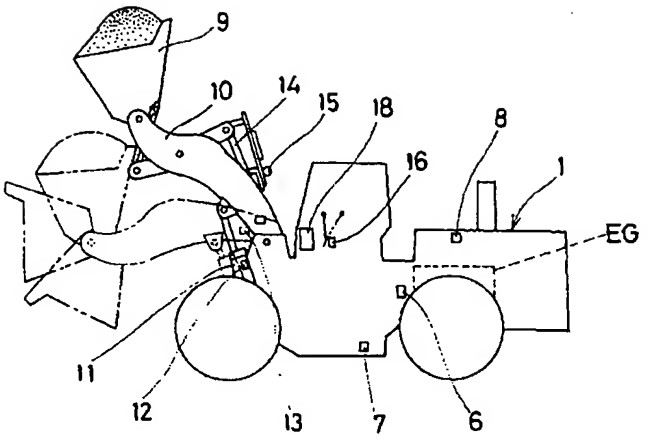
また、処理器23を適宜操作することにより第４図のような報告書が表示される。そして、最終的にユーザーに提供するものはこの報告書であり、これをプリンター24によつてプリントアウトされる。この報告書には計測月日、計測結果、作業性能が記載されている。

このように、ホイルローダ本体１に設けられた検出装置２により所望作業量を検出し、前記ホイルローダ本体１に取付けられた記録装置３に前記検出装置２の検出信号を入力してこれを記録媒体４に記録させ、作業終了後に記録媒体４を記録装置３から取出し、該記録媒体４を管理者側の分析装置５で読取り分析するようにしたことにより、次のような効果がある。

すなわち、記録装置３に内蔵する時計機能と積込み完了信号とを用いて各積込みに要したサイクルタイムを把握し、各サイクルタイムにおける作業量および燃費を検出して、時間当たりの作業量および燃費当たりの作業量を算出することにより、従来、一面的に作業性能や燃費を論じていたものを関連ずけて評価でき、分析結果から総合的な作業能率の善し悪しを一目で把握できる。また、時間当たりの作業量と目視によつて得た作業工程データとを比較すれば、作業の改良点がすぐに判断でき、ユーザーの作業方法改善に適切なアドバイスをすることができる。

さらに、同時に測定するエンジン回転数分布（必要に

【第３図】



【第４図】

現場計測結果報告書（速報）

1．計測月日

開始	87/07/10	8: 9:50
終了	87/07/10	11:39:31

2．計測結果

1)	総作業量	1035.44 トン
2)	総サイクル数	202 回
3)	平均サイクルタイム	1: 2 分：秒
4)	平均積載量	5.13 トン
5)	燃料消費量	20.85 リットル/Hr

3．作業性能

燃料当り作業量	14.20 トン/リットル
時間当り作業量	296.72 トン/Hr

【第５図】

7/05/25

回数(回)	荷重(t)	累積(t)	サイクルタイム	経過時間	燃費(CC)
1	4.17	6.90	0:39	14: 8:40	95
2	3.06	9.96	0:36	14: 9:16	195
3	3.15	13.11	1:42	14:10:58	175
4	3.33	16.44	0:31	14:11:29	375
5	3.17	19.61	0:29	14:11:58	160
6	3.19	22.80	0:27	14:12:25	140
⋮	⋮	⋮	⋮	⋮	⋮
25	3.37	90.05	0:40	14:24:31	390
26	3.71	93.76	0:37	14:25: 8	170
27	3.51	97.27	0:37	14:25:45	155
28	3.37	100.64	0:47	14:26:32	180
29	3.72	104.36	0:35	14:27: 7	165

【第６図】